B. Geology and Paleontology

The geology of the CPNA is the product of millions of years of erosion, sediment deposition, faulting, volcanism and uplift. From a geological perspective, the mountains and valleys are relatively young. Most of the sediments which consolidated to form the rocks were deposited well after the extinction of dinosaurs.

Marine sedimentary rock predominates in both the Caliente and Temblor Ranges. This sedimentary rock has both a non-organic and an organic origin. Non-organic sedimentary rock includes sandstone, clay-shale and conglomerate containing boulders and cobbles. Sedimentary rock of an organic origin includes shale composed of the remains of microscopic plants and animals with a varying component of clay. Additionally, sandstones, shales and conglomerate of marine and non-marine origin is interlayered with volcanic flows in the Caliente Range.

The San Emigdio and Sierra Madre Ranges to the south consist of similar rock formations. However, these ranges are orientated east-west compared to the north-south trend of the Temblor and Caliente Ranges.

About nine million years ago the granitic northern Gabilan Range lay directly west of the present-day southern Temblor Range. Boulders, cobbles and coarse sand were eroded from this granitic terrain into a near-shore environment. Movement on the San Andreas Fault has since displaced the northern Gabilan Range 120 miles north. This sedimentary rock is exposed in the vicinity of Cochora Ranch in the Temblor Range and is known as the Santa Margarita Formation. Several listed plant species are found on soil derived from this formation.

During wetter periods of recent geologic history, runoff from the Carrizo Plain drained north via the ancestral Salinas River. Since then, uplift at the north end of the Carrizo Plain has cut off this drainage causing all runoff to drain to the lowest part of the plain - Soda Lake. More springs are found in the Caliente Range than in the Temblor Range. This may be attributed to higher precipitation on the Caliente Range, the presence of volcanic rocks or faults which act as groundwater dams forcing water to the surface and to higher diatomaceous shale content in the Temblor Range which may be more permeable and absorptive.

The CPNA is distinguished for its world-class fossil assemblages (paleontology) and well exposed rock outcrops (stratigraphy). Several rock formations were first recognized and defined within the CPNA. Present within the CPNA are the "type locale" (site of the first definitive published description) of the Pattiway and Simmler Formations, the Saltos Shale and White Rock Bluff members of the Miocene Monterey Formation, the Soda Lake Shale and Painted Rock members of the Vaqueros Formation, and the Paso Robles, Caliente and Morales Formations. These locations will be of continuing academic interest.

The Caliente Formation contains diverse terrestrial fossil remains interfingered by fossil-bearing marine sedimentary rocks. The formation records continuous deposition during the Miocene Epoch (from 13 million to 25 million years before present) and contains the original type locale for an early horse species.

The San Andreas Fault, 625 miles long, traverses the CPNA from north to south near the western base of the Temblor Range. The surface trace of the fault is displayed by creek bed offsets and fault scarps, which are particularly well-preserved in the Carrizo Plain. In part because of the preservation of these physical features, there has been considerable academic research of the fault. The Fort Tejon earthquake of 1857, with a magnitude over 8.0, was centered in the CPNA and is probably the strongest earthquake to hit California within historic time. Surface ruptures extended a total of 200 miles and offsets of 30 feet occurred within the CPNA. Future seismic activity within the CPNA is highly likely. Earthquake preparedness is addressed in the safety and law enforcement section of this document.

Research has been conducted on geological and paleontological aspects of the CPNA since the 1906 San Francisco earthquake. Recent geophysical investigations measuring natural electrical current present at the earth's surface have been particularly successful due to the CPNA's isolation from populations centers and lack of electrical interference. These investigations provide geophysicists a passive method to determine rock types several miles below the surface to help study the geology across the San Andreas Fault. Low rainfall and sparse vegetation enhance opportunities to map geologic formations and features. Work within the CPNA has enabled reconstruction of earthquake events over the last 2,000 years and has improved understanding of the San Andreas Fault.

1. Climate

The climate of the region can be generally characterized as Mediterranean, with warm dry summers and cooler damp winters. Summertime high temperatures frequently exceed 100 degrees Fahrenheit but average in the high 90's. Summertime low temperatures range in the mid to upper 50's. Winter daily temperatures range from highs in the mid 60's to lows in the mid 30's. Temperature extremes are 115 and 0. The higher elevations of both the Temblor and Caliente Mountains are considerably cooler year-round.

About 90% of the total annual rainfall is received between November and April. Winters are usually mild, with clear days and intermittent periods of precipitation. Rainfall averages 10 inches per year, but varies considerably depending on location with the driest parts averaging less than five inches per year. The predominate wind direction is northwesterly but, extreme winds associated with major winter storms are usually southerly. Average wind speeds are less than 10 mph and occur frequently in the summer.

A Remote Automatic Weather Station (RAWS) is located south of Washburn Ranch, at the base of the Caliente Mountain. The RAWS sends hourly weather observations every three hours, via satellite, to the BLM's fire management headquarters in Boise, Idaho. The information can be retrieved at the Bakersfield Communication Center (BBD) on the Initial Attack Management System (IAMS) computer and statistical analysis of these observations are available for yearly and multi-year periods. The following data are gathered: rainfall, average wind speed, wind direction, temperature, relative humidity, one hour and 10 hour fuel moistures, fuel temperature, wind speed and direction of gusts.

Three other automated weather gathering stations have been installed within the CPNA. Data from these stations are periodically gathered by project staff and researchers. The location of these stations are in the (Appendix B).

2. Air Quality

San Luis Obispo County is considered in "nonattainment" for pollution level reduction of both ozone and PM10 (fine particulate matter or dust less than 10 microns in diameter), but does not regard the CPNA as a source or concentration area for air pollution. The factors for this, are extremely low population density, little industry, and few major transportation corridors. Prescribed fires are permitted by the San Luis Obispo Air Pollution Control District (APCD), and since the CPNA is mostly above the 2000 foot ceiling for smoke and dust control, requests for prescribed fires are generally readily approved. Additionally, most fires are in light fuels (grass and forbs) which produce less smoke than fires in moderate to heavy fuels (shrubs and trees).

Occasionally, easterly winds transport pollutants into the CPNA from the San Joaquin Valley. The southern and eastern portions of the CPNA most frequently receive the heaviest accumulations.

3. Hydrology

The CPNA watershed is an internal drainage basins which lie between the La Panza and Caliente Ranges on the west and the Temblor Range to the east. These mountains join together to close the basin at the southeastern tip of the CPNA. Runoff on the southern and western portions of the Caliente Mountain Range drains into the Cuyama Valley.

No perennial streams or creeks are present. Intermittent and ephemeral streams transport winter and spring runoff to Soda Lake. Water also collects in numerous vernal pools, primarily on the north end of the CPNA, providing unique habitat for characteristic plant and animal species.

Water may be present for only a few days some years or in wet years from October into June. Natural springs are common on the Caliente Mountain, but few springs are present on the Temblor Mountain. Inventory records show approximately 40 springs within the CPNA. Of these, 11 are recorded as Public Water Reserves (PWR), and are on file at the Caliente Resource Area office. Fifteen springs have been developed for livestock use and most are also available for wildlife.

Due to the dry conditions and past land uses, riparian communities are poorly represented. They typically consist of a few species in small numbers surrounding perennial springs, but potential exists to improve the species composition at some springs and to increase the distribution of riparian vegetation.

4. Soils

Field work for the Carrizo Plains Soil Survey was completed in 1991 and preliminary maps and soil descriptions are available. A general overview of soils of the Carrizo follows:

Soils on Alluvial Plains, Alluvial Fans and Flood Plains: The soils in this group vary considerably, depending on slope, in terms of permeability and depth. Slopes are nearly level to moderate. The soils in these areas are very deep to shallow (hard pans, clay pans, etc.), and poorly drained to somewhat excessively drained. Soil particle sizes range from sand to clay.

Soils on Terraces: Slopes on terraces are nearly level to very steep. These soils are shallow to very deep and well drained. Soil particle sizes range from coarse sandy loam to loam. The major land use, in the past, was for cultivated crops and range.

Soils on Hills and Mountains: Slopes are moderately steep to very steep. These soils are shallow to deep, and well drained to somewhat excessively drained. Soil particle sizes range from loamy sand to silty clay.